



June 13, 2018

Reference No. 083101

Mr. Lyle DeLaRosa
PA Department of Environmental Protection - SERO
2 East Main Street
Norristown, Pennsylvania
U.S.A. 19401-4915

Dear Mr. DeLaRosa:

**Re: Site-Specific Standard (SSS) Addendum for Final Summary Report
U. S. Steel – Mon Valley Works Fairless Hills
52-Acre Parcel
One Ben Fairless Drive, Fairless Hills
Falls Township, Buck County, Pennsylvania**

This letter presents an addendum to the Act 2 Notice of Intent to Remediate (NIR) and Final Report Summary for the 52-Acre Parcel at the U. S. Steel (USS) Mon Valley Works Fairless Hills (aka KIPC) property.

GHD has prepared this addendum in response to your comments in your email sent May 30, 2018 regarding the use of Upper Confidence Limits (UCLs) to demonstrate attainment of Statewide Health Standards (SHS) for Compounds of Concern (COCs) in soil. GHD has since re-calculated Site-Specific Standards (SSS) for the compounds for which UCLs had been previously calculated, namely: iron, lead, and benzo(a)pyrene.

The memorandum attached presents the SSS calculation methods and results, and is intended to be included within Appendix B of the Final Summary Report for the 52-Acre Parcel. The addendum demonstrates that the concentration of iron, lead, and benzo(a)pyrene within the surface and subsurface soil samples collected from the Site are below the calculated SSSs for these COCs. Therefore, USS has demonstrated attainment of a SHS or SSS for all COCs analyzed in soil as part of the remedial investigation for on-Site surficial and subsurface soil.



Should you have any questions or comments regarding the attached, please contact John Garges at 610-321-1800.

Sincerely,

GHD

A handwritten signature in black ink that reads "John A. Garges". The signature is written in a cursive style with a large, stylized "J" and "G".

John Garges, P.G.

JG/kf/1

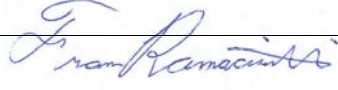
Encl.

cc: Linda Matyskiela, EPA
Michael Leon, U. S. Steel



Memorandum

June 13, 2018

To: Michael Leon  Ref. No.: 083101

From: Francis C. Ramacciotti/Alex Kliminsky/kf/22

CC: Michael Tomka, Jody Vaillancourt

**Subject: Proposed Site-Specific Standards for B[a]P, Lead, and Iron
52-Acre Parcel, Fairless Hills Facility, U.S. Steel, Fairless Hills, Bucks County,
Pennsylvania**

1. Introduction

U. S. Steel (USS) has completed an investigation of the 52 Acre Parcel (Site) which is part of the Mon Valley Works Fairless Hills Facility (a.k.a. Keystone Industrial Port Complex [KIPC]) (Facility) in order to pursue a relief of environmental liability in accordance with Chapter 250 (Act 2) for soil.

The investigation of the 52 Acre parcel identified five soil samples with concentrations of benzo[a]pyrene (B[a]P), iron, or lead exceeding the Pennsylvania Department of Environmental Protection (PADEP) Statewide Health Standard (SHS) Medium-Specific Concentration (MSC).¹ The MSCs for benzo[a]pyrene (B[a]P), iron, and lead are 12 milligrams per kilogram [mg/kg], 190,000 mg/kg, and 1,000 mg/kg, respectively. The soil result of 16 mg/kg of B[a]P in shallow soil exceeded the MSC. The soil result of 2,270 mg/kg of lead in shallow soil exceeded the MSC. The soil results of 201,000 and 212,000 mg/kg of iron in shallow soil exceeded the MSC. The soil result of 184,000 mg/kg of iron in deep soil exceeded the MSC.

USS has further evaluated B[a]P and iron concentrations and potential human health hazards and has developed the following Site Specific Standards (SSSs') based on the Site maximum concentrations within soil (0 to 2 foot interval) plus a factor of 10 percent. For lead, the SSS is based on the United States Environmental Protection Agency's (USEPA's) 2003 Adult Lead Methodology (ALM)² and USEPA's 2017 recommendations for background and standard deviations of blood lead levels in the adult population

¹ PADEP, 2016: Chapter 250: Administration of Land Recycling Program, Subchapter C: Statewide Health Standards, Pennsylvania Department of Environmental Protection, August 27, 2016.

² United States Environmental Protection Agency (USEPA). 2003. Office of Solid Waste and Emergency Response (OSWER). Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposure to Lead in Soil. EPA 540 R 03 001. January.



(USEPA, 2017)³. The remainder of this memorandum presents the calculations and assumptions used to support the proposed SSSs for B[a]P, iron, and lead.

2. Site-Specific Standards for Benzo(a)pyrene and Iron

The SSS of 17.6 mg/kg (16 mg/kg x 1.10) and 233,000 mg/kg (212,000 mg/kg x 1.10) are proposed for attainment of B[a]P and iron at the Site, respectively. The industry acceptable analytical repeatability of groundwater and soil samples ranges from 20 to 35 percent. Therefore, 10 percent was conservatively added to the maximum detected concentration to account for the potential variability of the sampling and analytical methodologies. To demonstrate that these B[a]P and iron concentrations will not result in a hazard above PADEP (2016⁴) acceptable levels, the hazard associated with exposure to these SSSs were calculated considering all potential exposure routes. The soil exposure routes to concentrations of B[a]P and iron in soil at the Site considered were incidental ingestion, dermal contact, and inhalation of particulates. The equations used to evaluate the exposure are based on USEPA guidance as noted below which are consistent with the equation presented in PADEP (2016). The equations used to determine the intake via these exposure routes to the soil are presented in the following section.

2.1 Intake Equations

Soil Incidental Ingestion Exposure Pathway

The chronic daily intake equation for calculating chemical intake from the incidental ingestion of soil after USEPA (1989⁵) is:

$$CDI = \frac{CS \times IR \times EF \times ED \times CF}{BW \times AT}$$

where:

<i>CDI</i>	=	Chronic daily chemical intake via ingestion (mg/kg body-weight/day)
<i>CS</i>	=	Chemical concentration in soil (mg/kg)
<i>IR</i>	=	Ingestion rate (mg soil/day)
<i>EF</i>	=	Exposure frequency (days/year)
<i>ED</i>	=	Exposure duration (years)
<i>CF</i>	=	Conversion factor (10 ⁻⁶ kg/mg)

³ United States Environmental Protection Agency (USEPA). 2017. Update of the Adult Lead Methodology's Default Baseline Blood Lead Concentration and Geometric Standard Deviation Parameters and the Integrated Exposure Uptake Biokinetic Model's Default Material Blood Lead Concentration at Birth Variable. OLEM Directive 9285.6 56. May.

⁴ PADEP, 2016: Chapter 250: Administration of Land Recycling Program, Subchapter C: Statewide Health Standards, Pennsylvania Department of Environmental Protection, August 27, 2016.

⁵ USEPA, 1989. EPA Risk Assessment Guidance for Superfund (RAGS), Volume I, Human Health Evaluation Manual (Part A) (RAGS), EPA/540/1-89/002, December.



BW = Body weight (kg)

AT = Averaging time (averaging period, days)

Soil Dermal Contact Exposure Pathway

The chronic daily intake equation for calculating chemical intake from dermal exposure to soil (USEPA, 1989) is:

$$CDI = \frac{CS \times SA \times AF \times ABS \times EF \times ED \times CF}{BW \times AT}$$

where:

CDI = Chronic daily chemical intake via dermal contact (mg/kg body-weight/day)

CS = Chemical concentration in soil (mg/kg)

SA = Skin surface area available for contact (cm²/event)

AF = Soil to skin adherence factor (mg/cm²)

ABS = Absorption factor - dermal (unitless)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

CF = Conversion factor (10⁻⁶ kg/mg)

BW = Body weight (kg)

AT = Averaging time (averaging period, days)

Soil Particulate Inhalation from Soil Exposure Pathway

The intake equation for calculating chemical intake from the inhalation of particulates or vapors originating from soil (USEPA, 2002⁶), including the addition of the ET term from USEPA (2009)⁷, is as follows:

$$EC = \frac{CS \times ET \times EF \times ED \times (1/PEF)}{AT}$$

Where:

EC = Exposure concentration via particulate inhalation (mg/m³)

CS = Chemical concentration in soil (mg/kg)

ET = Exposure time (hours)

⁶ USEPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4 24, December.

⁷ United States Environmental Protection Agency (USEPA). 2009. Office of Emergency and Remedial Response. Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment). USEPA/540/R/070/002. January.



<i>EF</i>	=	Exposure frequency (days/year)
<i>ED</i>	=	Exposure duration (years)
<i>PEF</i>	=	Soil particulate emission factor (m ³ /kg)
<i>AT</i>	=	Averaging time (averaging period, days)

2.2 Exposure Factors

The generic nonresidential exposure assumptions based on values from PADEP (2016) were used to calculate the incidental ingestion, dermal contact, and inhalation intake exposures for the industrial/commercial worker. The exposure assumptions used in the calculation are presented in Table 1.

2.3 Toxicity Values

The toxicity values used in this risk assessment were compiled from U.S. EPA's hierarchy of sources (2005), as follows:

1. Integrated Risk Information System (IRIS)
2. Provisional Peer Reviewed Toxicity Values (PPRTV)
3. Other Toxicity Values

B[a]P is classified as a human carcinogen and iron is not classified as a carcinogen. Therefore, both cancer and non-cancer exposures were evaluated. The cancer toxicity value or slope factor (SF) for B[a]P for the incidental ingestion and dermal contact was taken from IRIS, which is the same value used in USEPA's Regional Screening Tables (RSLs) (2017)⁸. The inhalation toxicity value or unit risk factor (URF) for B[a]P was taken from IRIS which is the same value used in USEPA's RSLs (2017).

The non-cancer toxicity values or reference doses (RfDs) for B[a]P and iron for incidental ingestion and dermal contact exposure were taken from IRIS and PPRTV, respectively, which are the same values used in USEPA's RSLs (2017). The inhalation toxicity values or reference concentration (RfC) for B[a]P was taken from IRIS which is the same value used in USEPA's RSLs (2017).

The U.S. EPA sources of toxicity values referenced above do not provide dermal toxicity values for any of the constituents. Therefore, oral toxicity values (i.e., oral SFs and RfDs) are used as dermal toxicity values in this risk assessment. Adjustments to the oral toxicity values, where appropriate, are made in this route-to-route extrapolation following U.S. EPA guidance (U.S. EPA 2004)⁹.

2.4 Exposure Concentrations

The exposure point concentrations for B[a]P and iron used in the above intake equations were based on the Site maximum concentration (16 mg/kg) and (212,000 mg/kg) respectively plus 10 percent. As previously discussed, the 10 percent is conservatively based on potential variability of the sampling and analytical

⁸ United States Environmental Protection Agency (USEPA). 2018. USEPA Regional Screening Levels (RSL). May.

⁹ USEPA. 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. July.



methodologies. As a result the exposure point concentrations for B[a]P and iron used in the intake equations are 17.6 mg/kg (12 mg/kg x 1.10) and 233,000 mg/kg (212,000 mg/kg x 1.10), respectively.

2.5 Risk Estimate Associated with SSS

Table 2 presents the intakes as well as the associated cancer and non-cancer risks for each exposure route. As shown in Table 2, the cancer risk based on the SSS (maximum concentrations plus the 10 percent) is 4×10^{-6} which is below the PADEP's acceptable cancer risk level of 1×10^{-5} . Table 2 also presents the Hazard Index (HI) based on the SSS is 0.1, which is below the PADEP's acceptable HI of 1.

Therefore, the proposed SSSs' of 17.6 mg/kg for B[a]P and 233,200 mg/kg for iron does not result in an unacceptable cancer risk or HI greater than 1×10^{-5} or 1 and is protective of human health and the environment.

3. Site-Specific Standards for Lead

Potential exposure of workers to lead in soil is evaluated separately from the assessment for other constituents because USEPA evaluates the significance of lead exposures using blood lead level as an index of exposure, rather than in terms of cancer risk or non-cancer hazard quotient (HQ) (USEPA 2003)². As USEPA explained in promulgating the regulations at 40 CFR Part 745 (66 FR 1206, January 5, 2001), soil lead screening levels developed based on blood lead modeling should be compared with the arithmetic mean (average) concentration of lead within the area where potential exposures are assumed to occur in order to be consistent with the principles underlying the blood lead modeling approach. Therefore, evaluation of individual results for lead in soil (e.g., evaluation of individual results relative to screening criteria) is more conservative than necessary and evaluation of the average concentration of lead in soil over an exposure area is both protective and consistent with the model used to calculate the screening criteria.

The SSS for lead is proposed to be 3,200 mg/kg based on the Adult Lead Methodology (ALM). This SSS value is based upon the following considerations:

- The ALM, as described in USEPA 2003, was used to calculate the current lead SSS that is protective of USEPA's default target blood lead risk management level of 10 micrograms per deciliter ($\mu\text{g}/\text{dL}$) at the 95th percentile. USS proposes to use the updated values from the Center of Disease Control's National Health and Nutrition Examination Survey (NHANES) 2009-2014 dataset that USEPA used in its most recent ALM update (USEPA 2017)³ to calculate an updated SSS for lead.
- Consistent with the values used in Section 2.2 and shown in Table 1, the PADEP's default nonresidential exposure frequency (EF) of 180 days/year for soil exposure (25 PA Code § 250.305) is proposed to be used instead of the 219 days from USEPA 2003 that was used to calculate the current lead SSS.

Table 3 presents the inputs used in the ALM and the risk-based criterion of 3,200 that does not result in a blood lead level higher than $10 \mu\text{g}/\text{dL}$ and is thus protective of human health.



4. Closing

Based on the information contained in this memorandum and attachments, the Site characterization data, and evaluation of risk and hazards, the proposed SSSs attainment values of 17.6 mg/kg for B[a]P, 233,000 mg/kg for iron, and 3,200 mg/kg for lead are acceptable concentrations for use in soil attainment at the Site. Applying the SSS on a location-specific basis is conservative. As discussed above, comparing 95 percent UCLs to the SSS is protective.

Similarly, it is conservative to apply the SSS for lead on a location-specific basis. Per 40 CFR Part 745 (66 FR 1206, January 5, 2001) it is appropriate to compare the arithmetic mean concentration of lead in soil to the SSS.

Therefore, when considering the SSS values for B[a]P, iron, and lead, attainment has been achieved to a SSS for the 52-acre parcel.

Table 1

Values Used For Daily Intake Calculations - Industrial/Commercial Worker
52-Acre Parcel, Fairless Hills Facility, U.S. Steel
Fairless Hills, Bucks County, Pennsylvania

Medium: Surface and Subsurface Soil
 Exposure Medium: Soil
 Exposure Point: Ingestion, Dermal, and Inhalation
 Receptor Population: Industrial/Commercial Worker
 Receptor Age: Adults

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	(1)	(1)	Chronic Daily Intake (CDI) (mg/kg-day) = CS x IR x ABS x CF x EF x ED x 1/BW x 1/AT
	IR	Ingestion Rate of Soil	mg soil/day	50	PADEP, 2016	
	CF	Conversion Factor	kg/mg	1E-06	--	
	EF	Exposure Frequency	days/year	180	PADEP, 2016	
	ED	Exposure Duration	years	25	PADEP, 2016	
	BW	Body Weight	kg	80	PADEP, 2016	
	AT-C	Averaging Time (cancer)	days	25,550	PADEP, 2016	
	AT-N	Averaging Time (non-cancer)	days	9,125	PADEP, 2016	
	ABS	Absorption Factor	%/100	1	PADEP, 2016	
Dermal	CS	Chemical Concentration in Soil	mg/kg	(1)	(1)	CDI (mg/kg-day) = CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
	SA	Skin Surface Area Available for Contact	cm ² /event	3,527	USEPA, 2014	
	CF	Conversion Factor	kg/mg	1E-06	--	
	EF	Exposure Frequency	days/year	180	PADEP, 2016	
	ED	Exposure Duration	years	25	PADEP, 2016	
	BW	Body Weight	kg	80	PADEP, 2016	
	AT-C	Averaging Time (cancer)	days	25,550	PADEP, 2016	
	AT-N	Averaging Time (non-cancer)	days	9,125	PADEP, 2016	
	AF	Soil to Skin Adherence Factor	mg/cm ²	0.12	USEPA, 2014	
	ABS	Absorption Factor for B[a]P	%/100	0.13	USEPA, 2004	
	ABS	Absorption Factor for metals	%/100	-	USEPA, 2004	
Inhalation	CS	Chemical Concentration in Soil	mg/kg	(1)	(1)	Exposure Concentration (EC) (mg/m ³) = CS x ET x EF x ED x 1/(PEF) x 1/AT
	ET	Exposure Time	hours	8	PADEP, 2016	
	EF	Exposure Frequency	days/year	180	PADEP, 2016	
	ED	Exposure Duration	years	25	PADEP, 2016	
	AT-C	Averaging Time (cancer)	hours	613,200	PADEP, 2016	
	AT-N	Averaging Time (non-cancer)	hours	219,000	PADEP, 2016	
	PEF	Particulate Emission Factor	m ³ /kg	1E+10	PADEP, 2016	

Notes:

(1) The maximum detected concentration plus ten percent is used as the soil concentration. Ten percent is to allow for sample and analytical variability.

References:

PADEP, 2016: Chapter 250: Administration of Land Recycling Program, Subchapter C: Statewide Health Standards, Pennsylvania Department of Environmental Protection, August 27, 2016.
 USEPA, 2004: Superfund: Volume I Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) (RAGS), EPA/540/R/99/005, July.
 USEPA, 2014: Human Health Evaluation Manual, Supplemental Guidance: Update to Standard Default Exposure Factors, OSWER Directive 9200.1-120, February 6, 2014.

Table 2

Calculation of Chemical Cancer Risks and Non-Cancer Hazards for Industrial/Commercial Worker
52-Acre Parcel, Fairless Hills Facility, U.S. Steel
Fairless Hills, Bucks County, Pennsylvania

Receptor Population: Industrial/Commercial Worker
 Receptor Age: Adults

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	Maximum		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk (1)		Cancer Risk	Intake/Exposure Concentration		RfD/RfC (1)		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Soil	On-Site	Ingestion	Benzo[a] pyrene	1.76E+01	mg/kg	1.94E-06	mg/kg-d	1.00E+00	(mg/kg-d) ⁻¹	1.94E-06	5.42E-06	mg/kg-d	3E-04	mg/kg-d	1.81E-02
				Iron	2.33E+05	mg/kg	2.57E-02	mg/kg-d		(mg/kg-d) ⁻¹	NC	7.19E-02	mg/kg-d	7E-01	mg/kg-d	1.03E-01
			Exp. Route Total								1.94E-06					1.21E-01
			Dermal	Benzo[a] pyrene	1.76E+01	mg/kg	2.13E-06	mg/kg-d	1.00E+00	(mg/kg-d) ⁻¹	2.13E-06	5.97E-06	mg/kg-d	3E-04	mg/kg-d	1.99E-02
			Iron	2.33E+05	mg/kg	NA	mg/kg-d		(mg/kg-d) ⁻¹	NC	NA	mg/kg-d	7E-01	mg/kg-d	No uptake	
		Exp. Route Total								2.13E-06					1.99E-02	
		Exposure Point Total								4.07E-06					1.41E-01	
		Exposure Medium Total								4.07E-06					1.41E-01	
	Ambient Air	On-Site	Inhalation Particles	Benzo[a] pyrene	1.76E+01	mg/kg	1.03E-10	mg/m ³	6.00E-01	(mg/m ³) ⁻¹	6.20E-11	2.89E-10	mg/m ³	2E-06	mg/m ³	1.45E-04
				Iron	2.33E+05	mg/kg	1.03E-10	mg/m ³		(mg/m ³) ⁻¹	NC	3.83E-06	mg/m ³	(a)	mg/m ³	No Tox
		Exp. Route Total									6.20E-11					1.45E-04
	Exposure Point Total									6.20E-11					2.89E-04	
	Exposure Medium Total									6.20E-11					2.89E-04	
	Medium Total											4.07E-06				1.41E-01
Total of Receptor Risks Across All Media											4E-06	Total of Receptor Hazards Across All Media				1E-01

Notes:

NC = Not Calculated

(1) Regional Screening Level (RSL) Summary Table, May 2018 and Appendix A Table 5.B, PADEP, 2016.

Table 3

Calculated Site Specific Standard for Lead in Surface Soil
52-Acre Parcel, Fairless Hills Facility, U.S. Steel
Fairless Hills, Bucks County, Pennsylvania

			Industrial Workers
Incidental Ingestion of Soil			
Soil Lead Criterion		mg-Pb/kg-soil	3,200
Gastrointestinal absorption	AF	unitless	0.12
Ingestion rate	IR	mg-soil/day	50
Conversion factor		kg/mg	1E-06
Fraction contaminated		unitless	1
Exposure frequency	EF	days/year	180
Averaging time	AT	days	365
Uptake of lead		mg-Pb/day	9.5E-03
Uptake of lead		µg-Pb/day	9.47
Baseline blood lead	PbB_{baseline}	µg-Pb/dL	0.6
Biokinetic slope factor	BSF	µg-Pb/dL per µg-Pb/day	0.4
Geometric std deviation	GSD		1.8
Ratio of fetal PbB to maternal PbB	R_{f/m}	unitless	0.9
Target blood lead level		µg-Pb/dL	10
Proposed Updated Site Specific Standard		mg-Pb/kg-soil	3,200

Notes:

The proposed SSS is calculated using the approach and inputs described in the Adult Lead Methodology (USEPA 2003), except (1) the baseline blood lead level and associated geometric standard deviation are from USEPA's 2017 recommendations, and (2) the EF of 180 for industrial worker from 25 PA Code § 250.305.